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Defense Modeling & Simulation Office
Conceptual Models of the Mission Space (CMMS)

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M&S Master Plan

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Objective 1	*Objective 2*	*Objective 3*	*Objective 4*	*Objective 5*	*Objective 6*
Develop a common technical framework for M&S	Provide timely and authoritative representations of the natural environment	Provide authoritative representations of systems	Provide authoritative representations of human behavior	Establish a M&S infrastructure to meet developer and end-user needs	Share the benefits of M&S

- **M&S Master Plan has six objectives**
- **Most important is the technical framework**
  - **High Level Architecture**
  - **CMMS**
  - **Data Standardization**

An Overarching Technical Framework

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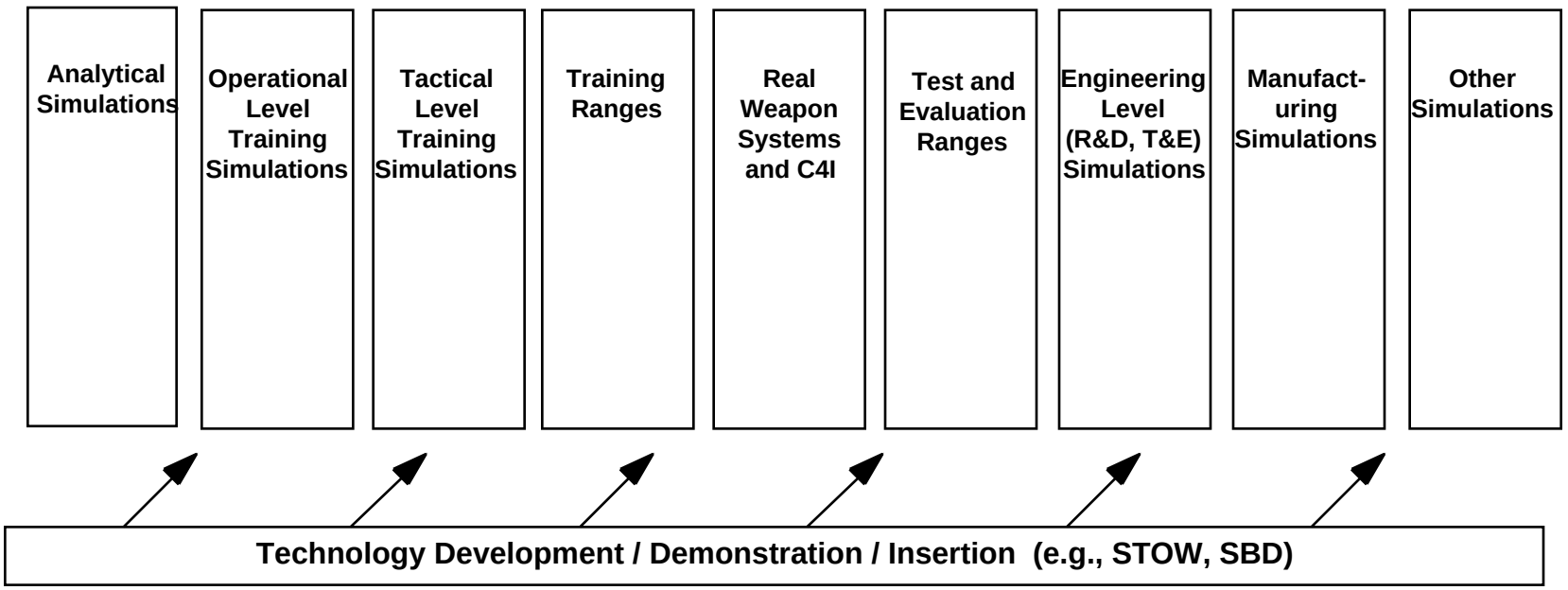
Master Plan's Technical Framework

High Level Architecture, Conceptual Models Of the Mission Space, Data Standardization

Domain-specific aspects



DoD M&S Strategy: An Analogy to City Planning

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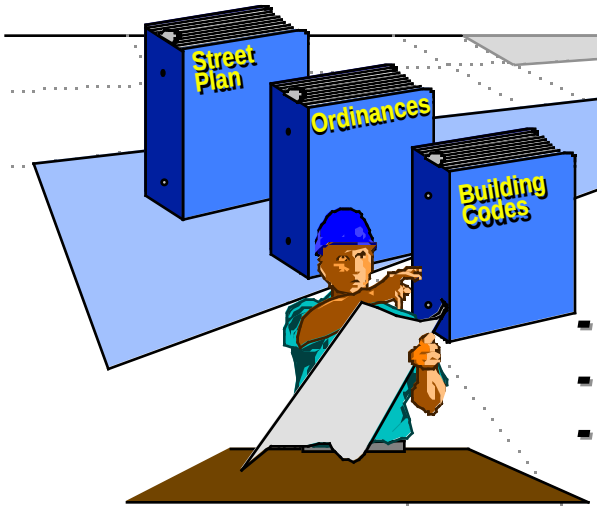
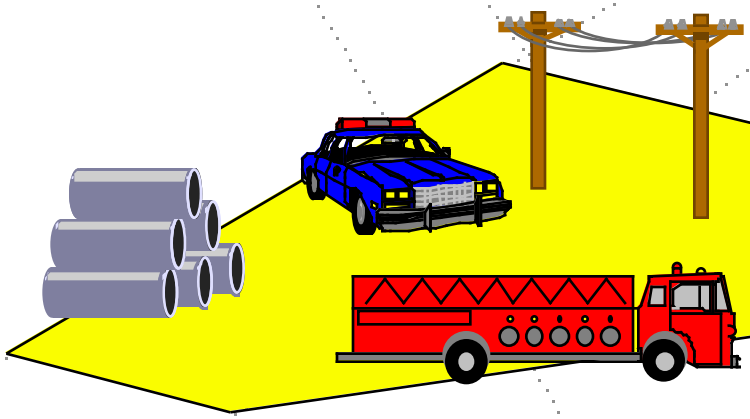


Technical Framework

- *High Level Architecture*
- *CMMS (common world view)*
- *Data standards*



Common Services

- *Environmental representations*
- *Communication networks*
- *VV&A methods*
- *Repositories*
- *Help Desk*
- *Education*

Payoffs: Interoperability and reuse = capability and cost-effectiveness

Tomorrow's Simulations will be Built on Reusable Elements

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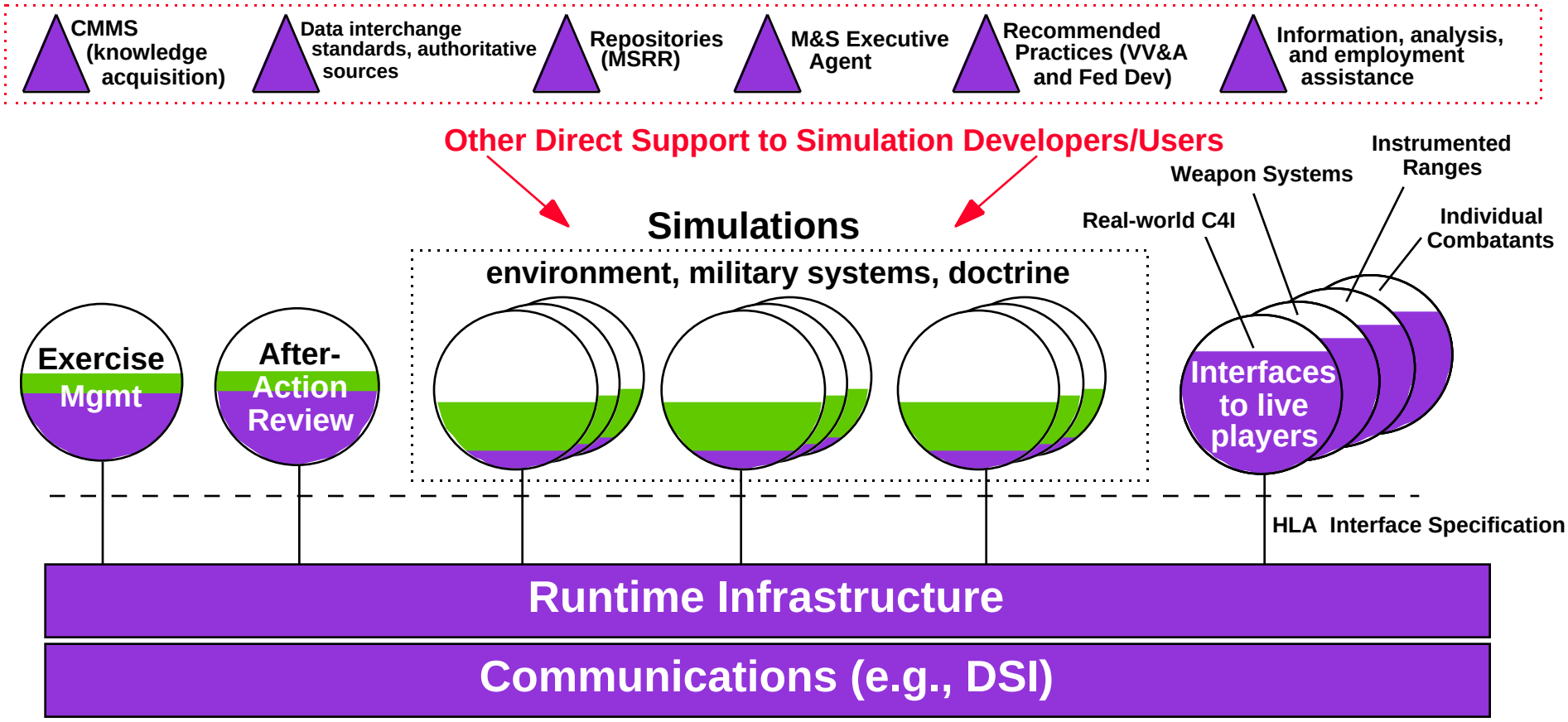

Key:

- Reusable across all DoD simulation systems
- Reusable across a simulation domain
- unique

CMMS Strategy

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- Today's simulations
  - No common technical framework
  - Different knowledge acquisitions for the same information
  - Knowledge acquisitions not authoritatively archived
- DMSO Master Plan
  - Advocates common technical framework - HLA/CMMS/Data Std
- Future M&S Programs
  - Common approach to understanding the real world
    - Authoritative source list
    - Technical framework with specific conditions and standards
    - Tools with hooks to simulation development
  - Coherently coordinated methods
  - Leverage each other's efforts
  - Increased interoperability and reuse of development efforts

CMMS

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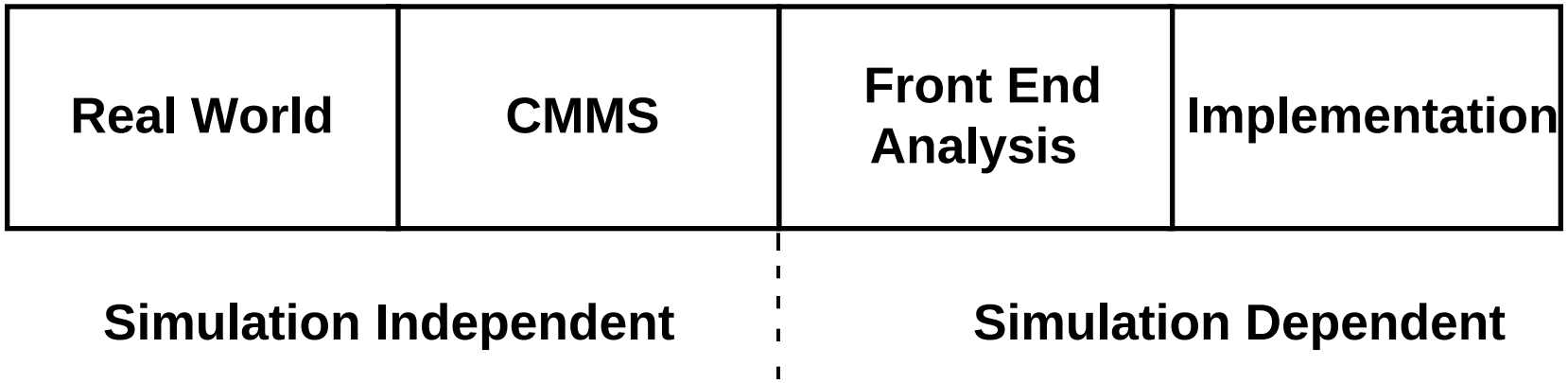
Simulation Development Process



What is a CMMS?

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- A hierarchical description of the actions and interactions among the various entities associated with a particular mission area
- An authoritative first abstraction of the real world
- A common framework for knowledge acquisition
  - Validated, relevant actions and interactions organized by specific task and entity/ organization
  - Standard format for expression
- The purpose of CMMS is to cost-effectively provide simulation developers (and others) a common understanding of the real world

CMMS Technical Framework

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- Purpose & Background
- Definitions
  - Authoritative Data Source
  - Common Syntax and Semantics
  - Entity, Action, Mission, Task, Interaction, etc.
- CMMS Content
  - Mission Space Descriptions
  - Integrated Conceptual Model
  - Authoritative Data Sources
  - Registration Description
- Process
  - Make Contributions (ADS; Create & Register)
  - Manage Contributions (CMMS Team; Integrate, Maintain & Release)
  - Use Contributions (M&S Developer; Locate & Extract)
- Structure
  - Data Structure Requirements
  - Support for Required Views
- Infrastructure
  - Modeling & Simulation Resource Repository (DBMS, CORBA, HTML)
  - User Interface (Access and account services)

Organizational Concept

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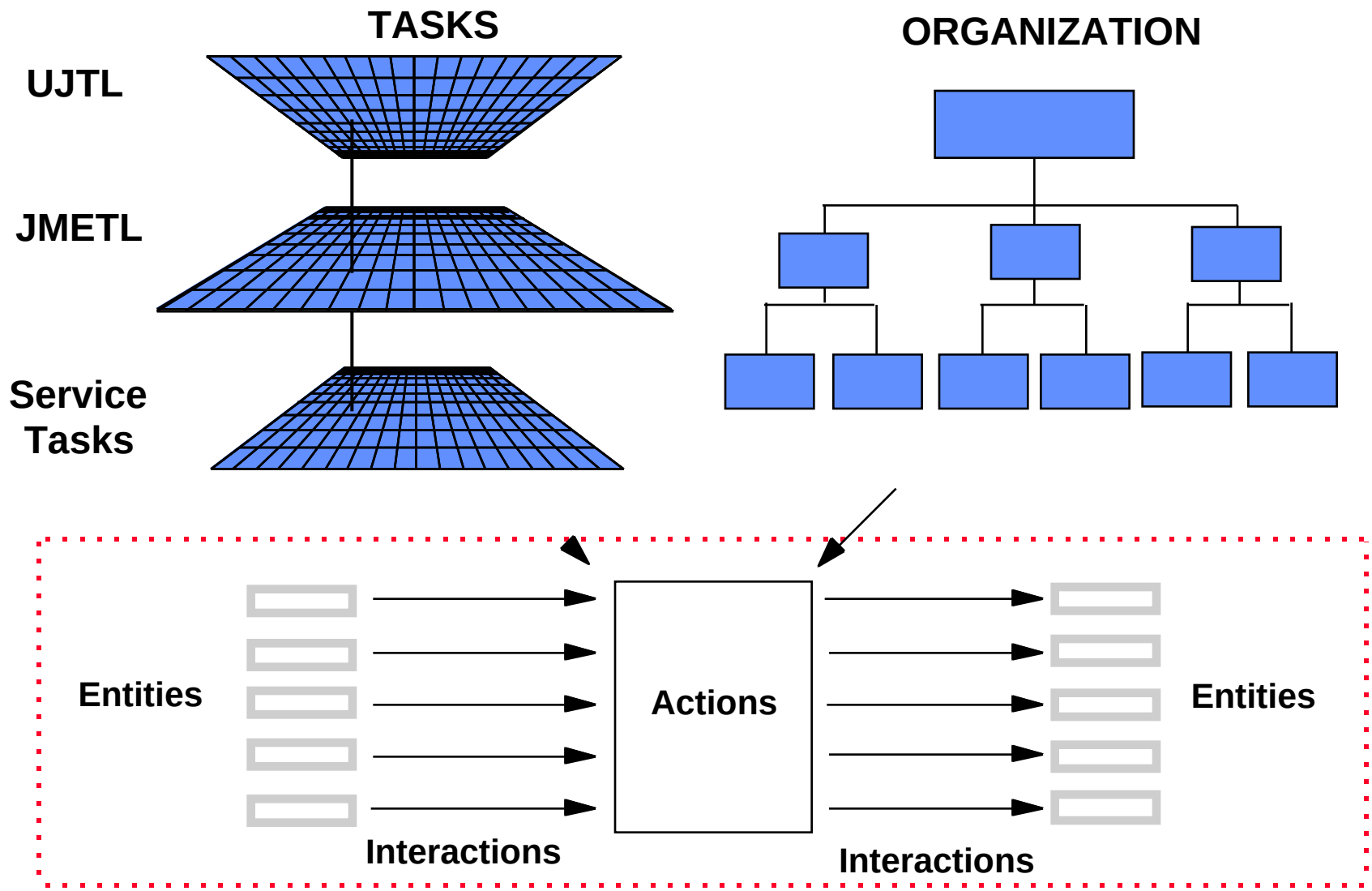

CMMS Illustrative Example
Interaction Selection Display

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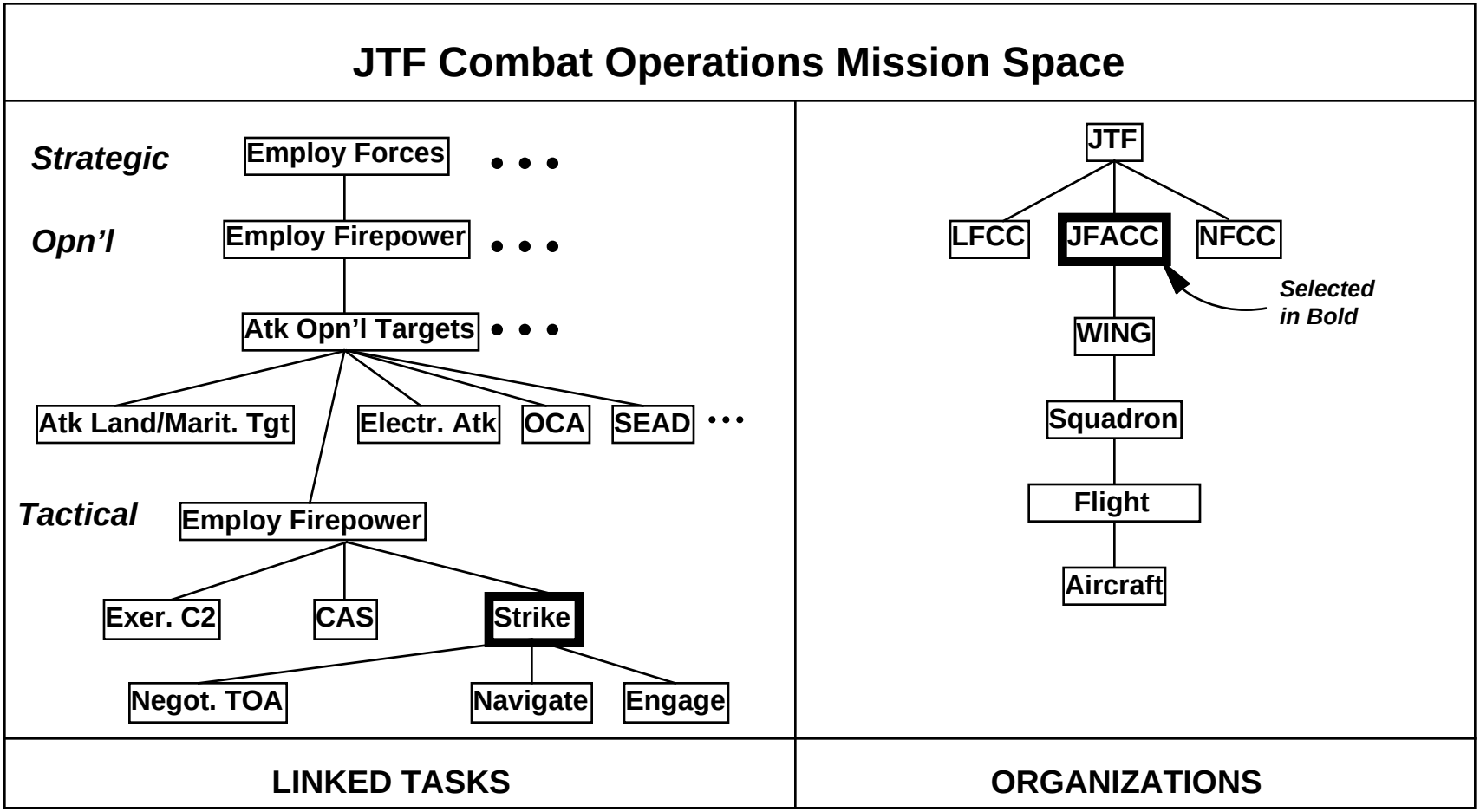

User Selects Interactions Involved in the Strike Task by the JFACC ...

Illustrative Example

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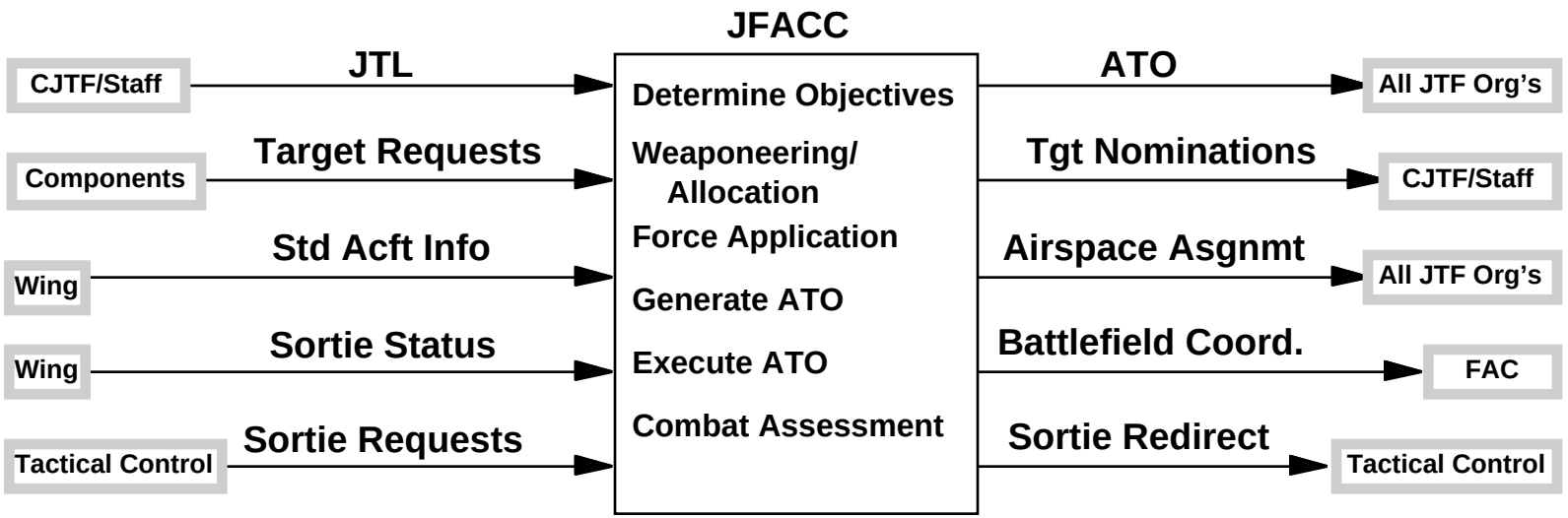
Interaction Display

JTF Combat Operations Mission Space



... Display Shows All Actions and Interactions for the Selection, in the Mission Space

CMMS Process

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Data Interchange Format / DIF

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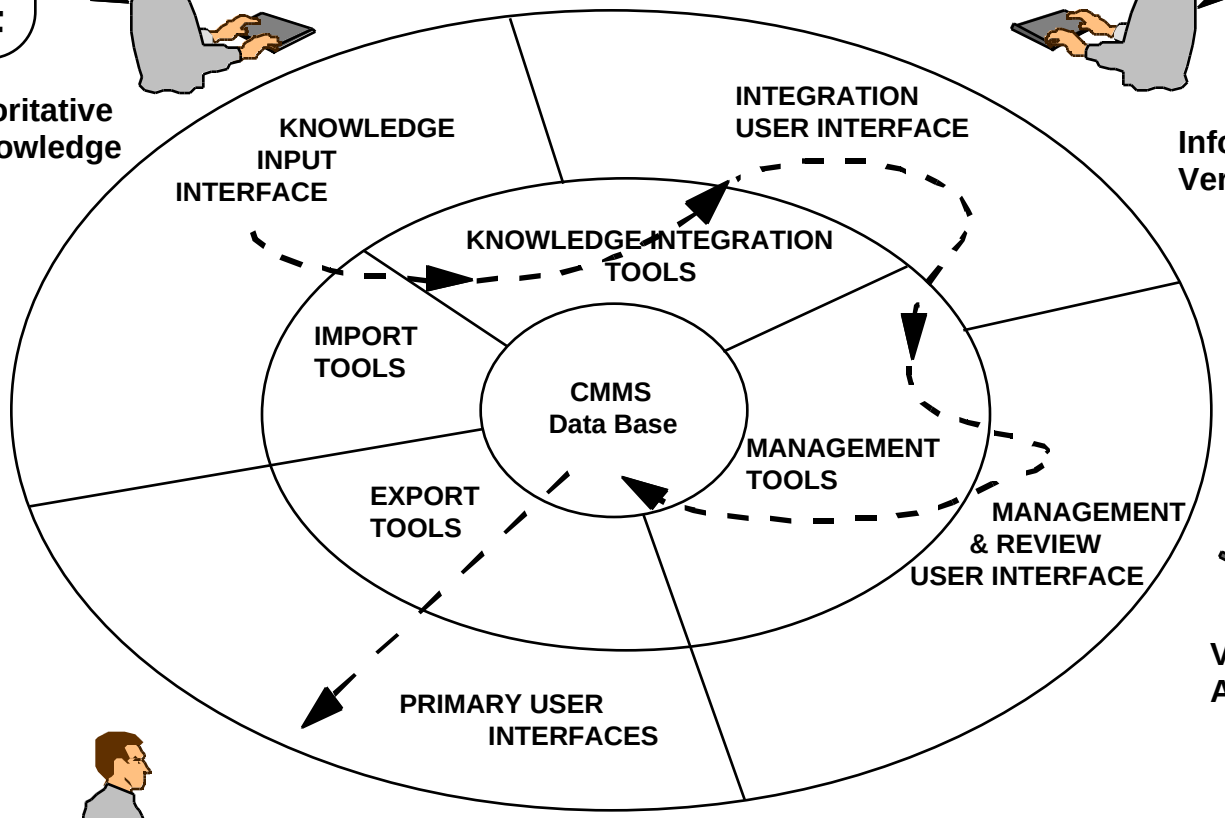
Verified, authoritative sources of knowledge

Information Verification/Integration



Validation by Authoritative Source

Simulation Developers, Warfighters (Doctrine Developers, Trainers, ...)

CMMS Prime Components

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INFORMATION SOURCES

WRITTEN
- Doctrine
- UJTL
- CINC JMETL
- Service tasks

ORAL
- Warfighter

DIF

KA Analysts

CAPTURED KNOWLEDGE

Feedback to authoritative sources

CMMS Users

USER INTERFACES

- Multiple user-requested views
  - Organization structure
  - Task structure
  - Model of interactions
  - Visualization of combat process
- Performance demands
  - Response time
  - Refresh rate
- User-friendliness

DATABASE

- CMMS elements:
  - Entities
  - Actions
  - Interactions
- Pointers to:
  - Knowledge acquisition history
  - Auth. Sources
  - Applicable models and simulations

MANAGEMENT PROCESS/TOOLS

- CMMS element integration
- Warfighter approval
- Functional area mission space mgt
- Resource/tool management

KNOWLEDGE CONVERSION PROCESS/TOOLS

- Check source, format, content
- Extract CMMS elements
- Deficiency correction
- Tool guidance
- Store in temporary database
- Convert CMMS elements for export

CMMS SYSTEM

Data comprising CMMS resides in and is accessible through the MSRR

CMMS Experiment Phase

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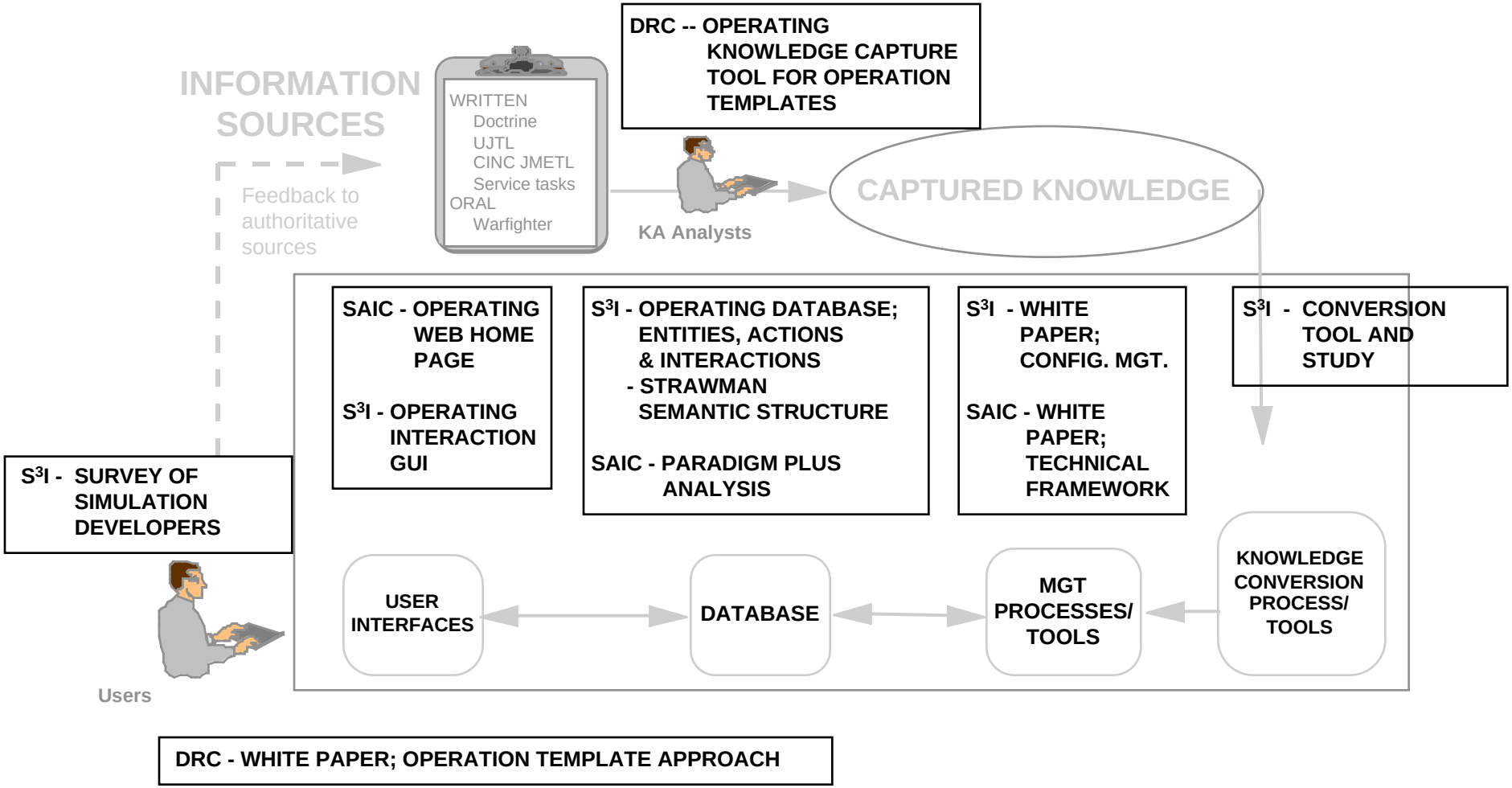
DRC, S3I and SAIC explored each area of the CMMS process with very limited data fill



Prototype Task

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- Contractor team selected
  - Software development capability
  - Combat mission space experience and connectivity
  - UJTL applications
- Rapid prototyping development
  - 2 spirals of development and user feedback
  - Generate understanding of requirements for fully operational CMMS
- Each spiral
  - Requirements analysis
  - Architecture analysis
  - Design/code
  - Demonstration and feedback from prospective users
- Final report

CMMS Prototype Phase

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Long Range Schedule

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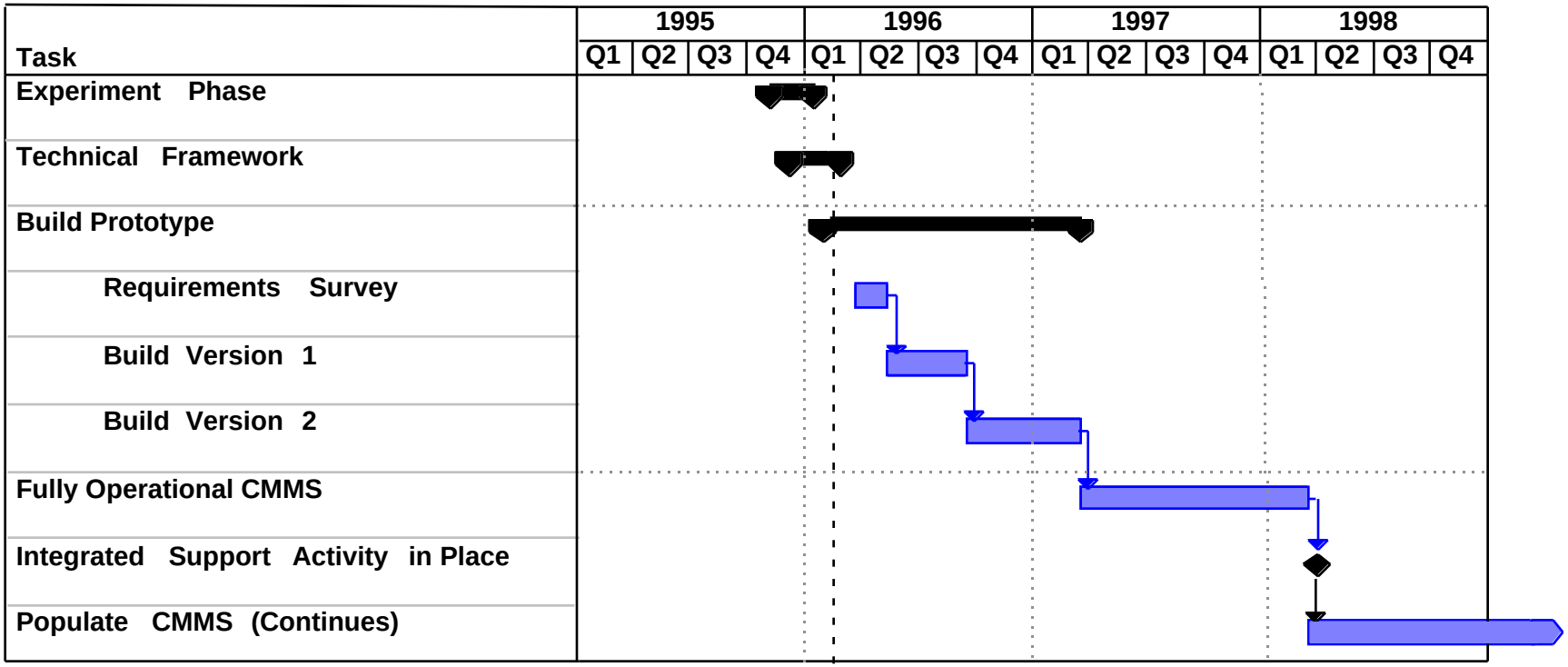
CMMS EXECUTION



Concrete Results of CMMS Efforts

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- JSIMS and JWARS are sharing a common mission space model and intend to share knowledge acquisition
- JSIMS may leverage NASM business process re-engineering efforts
- Data Interchange Format (DIF) effort may provide far-reaching standardization results
- CMMS experiments will provide simulation developers useful ideas and products, saving time and money
  - JWARS now working with CMMS contractor
  - WARSIM prototyping an event view using NASM Domain Analysis methods
  - Operation Template capture tool available to developers

Summary

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- DMSO's goal is
  - to give warfighters the tools needed to increase combat capability through the use of M&S, and
  - to foster interoperability and reuse among simulations, saving defense dollars
- Development involves joint and service M&S communities resulting in operationally viable tools
- Information transfer
  - Distributed to M&S community through workshops, meetings, web
  - POC's for common technical framework issues
    - HLA - Dr Judith Dahmann - jdahmann@dmso.mil
    - CMMS - Lt Col Mark Jefferson, USAF - mjeffers@dmso.mil
    - Data - LTC Peter Polk, USA - ppolk@dmso.mil
  - Web address for DMSO Homepage - www.dmso.mil
  - Phone (703) 998-0660
  - Fax (703) 998-0667

BACKUPS

CMMS Process Objectives

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- Identify authoritative sources of information
- Integrate information from independent knowledge acquisition sources
- Develop & maintain management processes
  - Plan for validation of real-world knowledge
  - Coordinated presentation of knowledge
- Establish a broadly applicable set of CMMS resources and tools

CMMS Process

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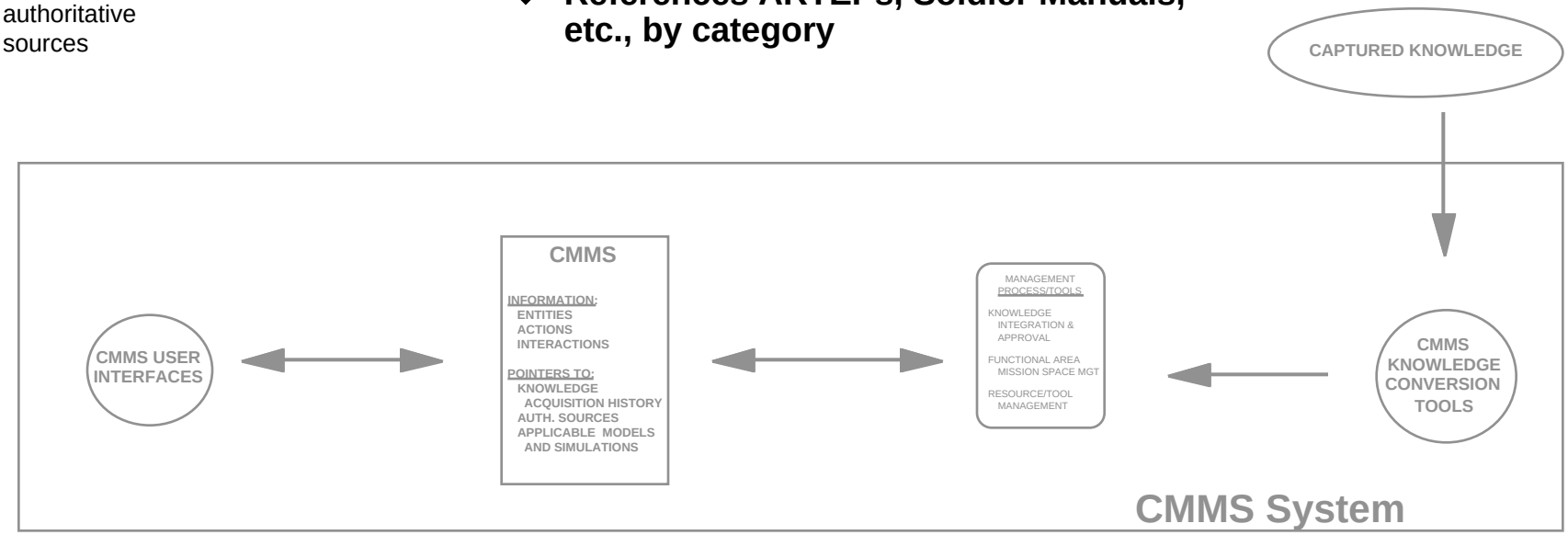
Information Sources

WRITTEN
- Doctrine
- UJTL
- CINC JMETL
- Service tasks

ORAL
- Warfighter

- **Support common knowledge acquisition authoritative sources**
- **List of Authoritative Sources**
  - **DMSO's draft is presently 90 pages, not exhaustive**
    - **No./Title, Source, Abstract**
  - **Sources**
    - **Joint Doctrine Pubs**
    - **Service Doctrine (Currently USA, USAF, USMC)**
    - **References ARTEPs, Soldier Manuals, etc., by category**

Feedback to authoritative sources



CMMS Process

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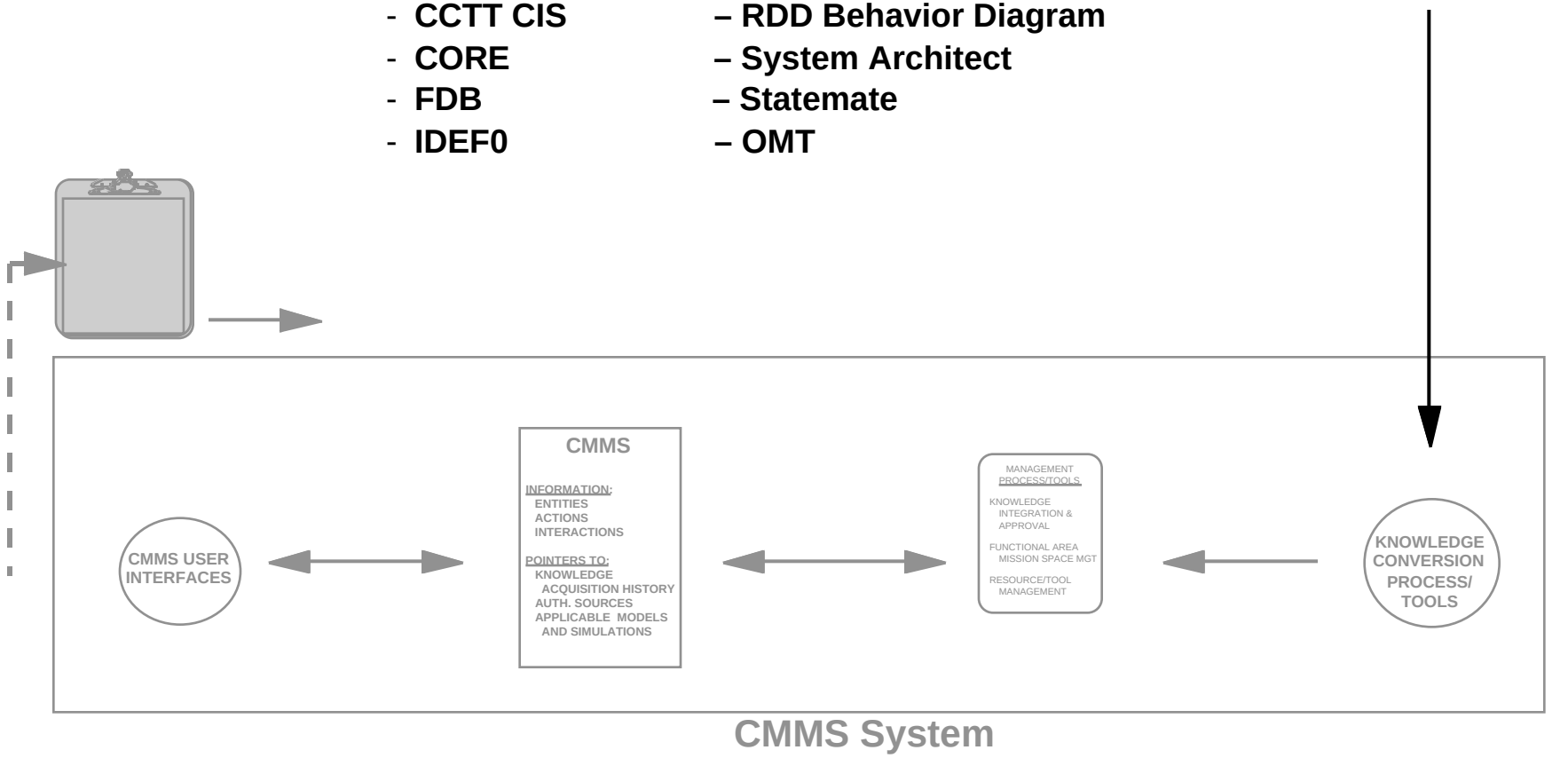
Capture Knowledge

- **Collaborative effort could yield standard interchange format**
- **Reviewing known processes/tools**
  - **CCTT CIS – RDD Behavior Diagram**
  - **CORE – System Architect**
  - **FDB – Statemate**
  - **IDEF0 – OMT**



CMMS Technical Framework

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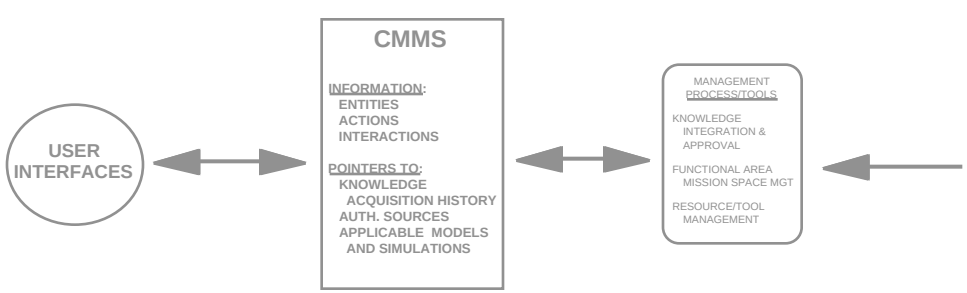
Knowledge Conversion



CMMS System

KNOWLEDGE CONVERSION PROCESS/TOOLS

- Check source
- Import knowledge
- Check format
- Check content
- Direct deficiency correction and tool guidance information to knowledge acquisition analyst
- Convert knowledge to database format
- Integrate knowledge
- Convert and export knowledge

CMMS Technical Framework

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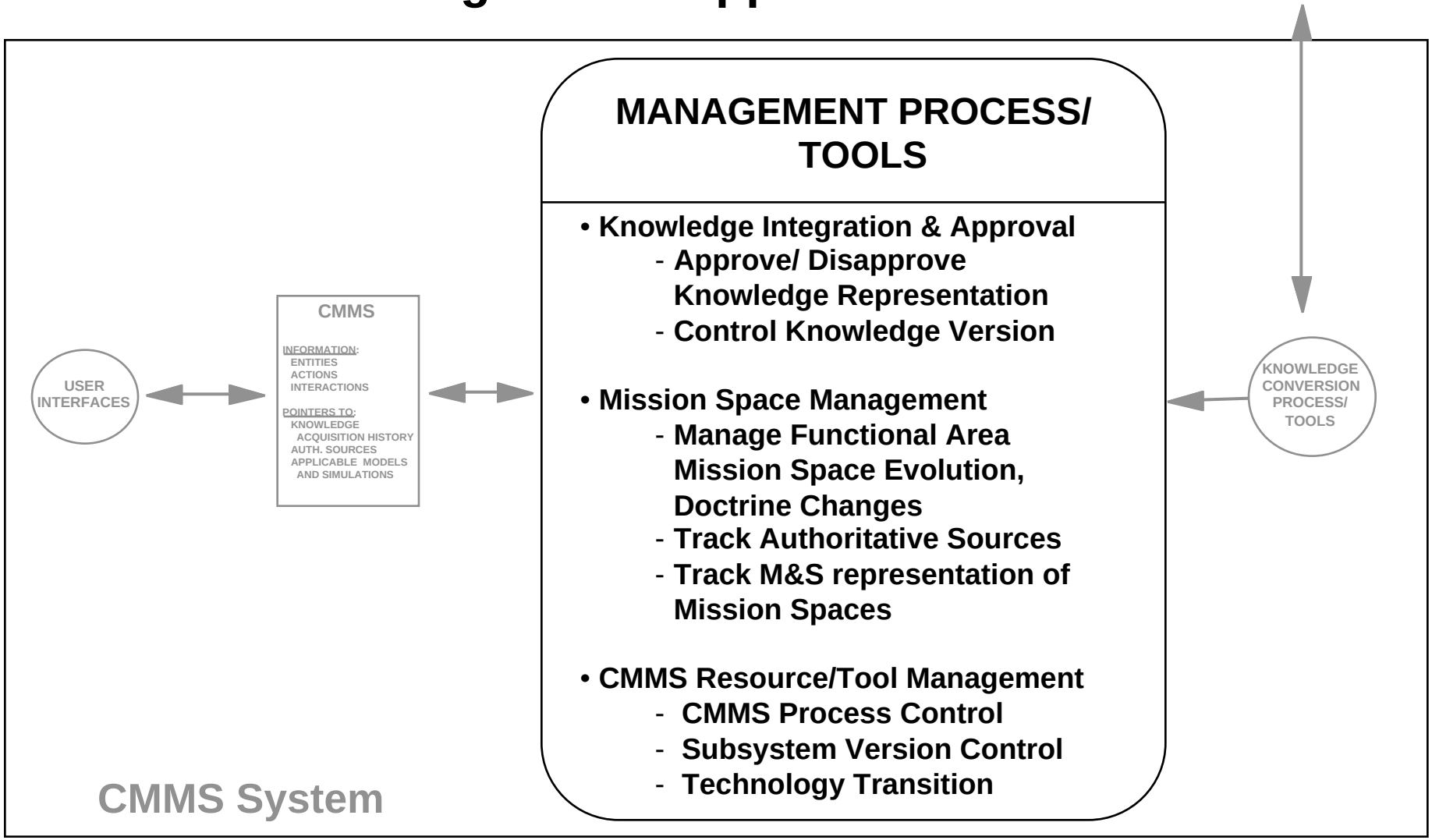
Management Support Functions



CMMS Technical Framework

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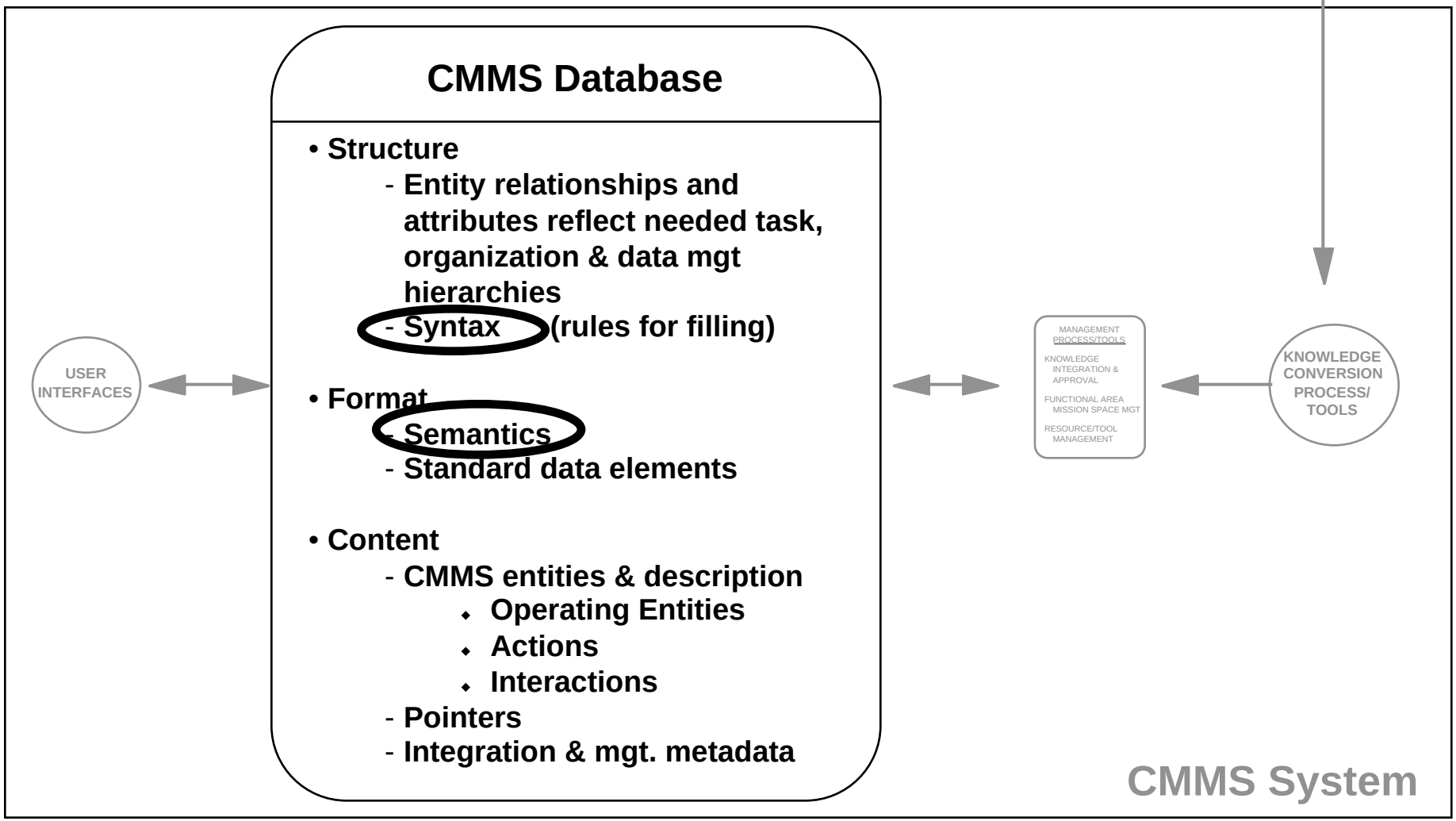
Characteristics of CMMS are driven by the user interface, knowledge conversion and integration, and management functions



CMMS Technical Framework

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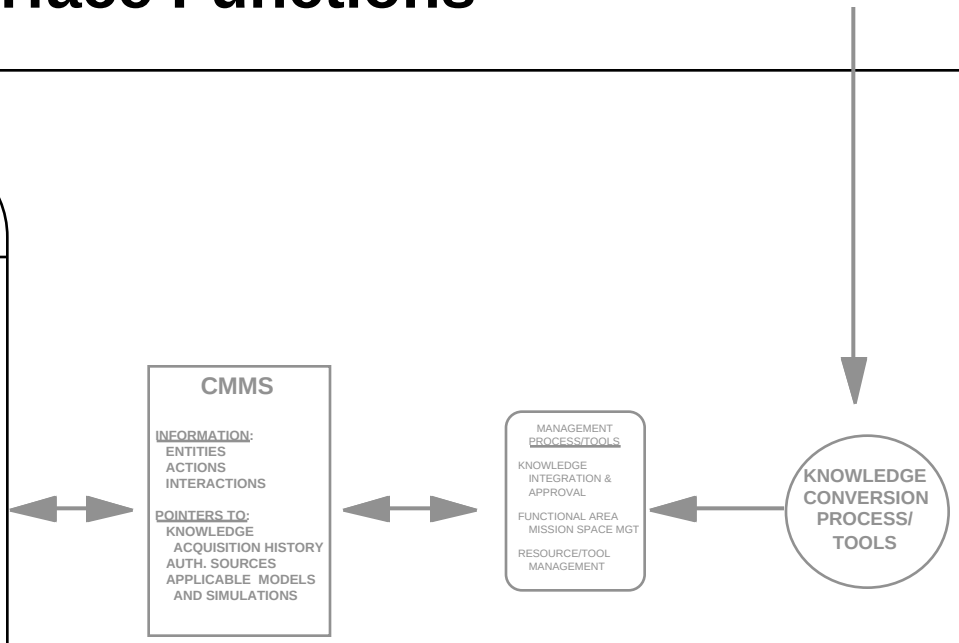
User Interface Functions

CMMS USER INTERFACE

- User-requested information
  - DoD entities and actions
  - Entity Interactions
  - Source
- Multiple user-requested views
  - Organization structure
  - Task structure
  - Model of interactions
  - Ability to visualize combat process
- User performance demands
  - Query response time
  - Graphic refresh time
- User-friendly



CMMS System

CMMS Experiment Phase

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- Further define CMMS concept
- Highlight and investigate relevant technical issues
- Provide insight into types of tools available and needed
  - DRC focus
    - User interface and tools for bringing unstructured knowledge into CMMS
    - UJTL expression in CMMS
    - Temporal view of operations and tasks through Operation Templates
  - SAIC focus
    - Tools for bringing partially structured knowledge into CMMS
    - WWW application to CMMS
  - S3I focus
    - Tools for bringing highly structured knowledge into CMMS
    - Database design and configuration management process
    - Primary user GUI